

CLAIMS

What is claimed is:

1. A device, comprising:

a housing having a fixed portion and a moveable portion, the moveable portion configured to move laterally with respect to the fixed portion;

a coupling member coupled to the moveable portion and the fixed portion; and

an actuator coupled to the coupling member, the actuator configured to output haptic feedback to the moveable portion of the housing via the coupling member.
2. The device of claim 1, wherein the coupling member is a flexure member.
3. The device of claim 1, wherein the haptic feedback is output based on an oscillation of a shaft of the actuator.
4. The device of claim 1, wherein the coupling member includes a first flexure member and a second flexure member, the first flexure member and the second flexure member being coupled between the moveable portion and the fixed portion, the actuator being configured to output the haptic feedback via at least one of the flexure members.
5. The device of claim 1, further comprising a manipulandum disposed adjacent to the moveable portion, the haptic feedback being imparted to the manipulandum.
6. The device of claim 1, further comprising a manipulandum disposed adjacent to the moveable portion, the haptic feedback being imparted to the manipulandum, the manipulandum is fixed in position with reference to the moveable portion.
7. The device of claim 1, further comprising a button disposed adjacent to the moveable portion, the haptic feedback being imparted to the button.

8. The device of claim 1, further comprising a button movable in a degree of freedom disposed adjacent to the moveable portion, the haptic feedback being imparted to the button in the degree of freedom.
9. The device of claim 1, further comprising a sensor coupled to the housing, the sensor being configured to detect a movement of the moveable portion with respect to the fixed portion.
10. A method, comprising:
 - sending a control signal to a processor associated with a graphical display, the control signal based on a position of a button in a degree of freedom;
 - receiving a haptic feedback signal from the processor, the haptic feedback signal being based on the control signal;
 - outputting a first haptic feedback to the button in the degree of freedom, and
 - outputting a second haptic feedback to a moveable portion of a housing in which the button is disposed.
11. The method of claim 10, wherein the first haptic feedback is associated with an interaction of a controlled object with a first simulated object in the graphical environment, the second haptic feedback being associated with an interaction of the controlled object with a second simulated object in the graphical environment.
12. A device, comprising:
 - a button depressible along a degree of freedom;
 - an actuator coupled to the button;
 - a sensor configured to detect a displacement of the button along the degree of freedom; and

a processor coupled to the actuator and configured to send a signal to the actuator based on the detected displacement, the actuator configured to generate the haptic feedback at least along the degree of freedom based on the signal.

13. The device of claim 12, wherein said actuator is a voice coil.

14. The device of claim 12, wherein the actuator includes a coil coupled to the button and a magnet coupled to a housing in which the button is disposed.

15. The device of claim 12, wherein the actuator includes a magnet coupled to the button and a coil coupled to a housing in which the button is disposed.

16. The device of claim 12, wherein the sensor is an analog sensor configured to output a position signal, the position signal associated with a position of the button.

17. The device of claim 12, wherein the haptic feedback includes a vibratory force produced as a function of time.

18. The device of claim 12, wherein the haptic feedback includes a spring force produced as a function of the displacement of the button.

19. The device of claim 12, wherein the haptic feedback includes a damping force produced as a function of a velocity of the button.

20. The device of claim 12, further comprising a flexure member coupled to the button and a housing in which the button is disposed.

21. The device of claim 12, wherein the button is integrated as part of a multi-directional manipulandum configured to control a graphical object.

22. The device of claim 12, further comprising:

a housing, the button being disposed in the housing; and

a trackball coupled to the housing, the trackball configured to control a position of

a cursor in a display.

23. The device of claim 12, further comprising:

a housing, the button disposed in the housing; and

a joystick coupled to the housing, the joystick configured to control a position of a graphical object.

24. The device of claim 12, wherein the haptic feedback is associated with one of a position and a movement of a graphical object in a graphical display.

25. The device of claim 12, wherein the processor is configured to communicate with a host computer, and send data associated with the detected displacement of the button.

26. The device of claim 12, the actuator being a first actuator, the device further comprising a second actuator configured to output a vibration.

27. The device of claim 12, further comprising an isometric controller configured to control a position of a cursor in a graphical display.